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ABSTRACT

This report presents the results of research undertaken to determine the individual learning styles of teacher trainees and to better understand the development of teacher competency, particularly as it relates to teacher trainee learning styles. The research was conducted over a nine-month period in the context of the regular Teachers College Preservice Program for Elementary Teachers at Columbia University. The research is divided into two studies. The first is a developmental study of teacher competency and the second a study of the influence of teacher trainee learning styles on the development of teacher competency. In the first study, models of teaching are described and three types of competencies (planning, teaching, and terminal) are identified. It is reported that practice increased the level of teaching competency in each model. In the second study, four learning styles are identified and tests are made to show the influence of trainee learning styles on response to training and on pupil outcomes (recall and concept attainment). It was found that, for all learning styles, level of competence varied with the complexity of the model, and that some styles are stronger in planning than in performance. (BD)

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A Study of Teacher Trainee Learning Styles and the Development of Competence

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Objectives and Rationale

Two objectives guided the formulation of the present research. The first was to determine the individual learning styles of teacher trainees and the second was to understand better the development of teacher competency, particularly its relationship to teacher trainee learning styles. These objectives were prompted by a belief that if competency-based teacher education (CBTE) is to avoid a premature death or to avoid serving as a battleground between the humanistic concern for individual differences and the quest for greater training efficiency and effectiveness, research bearing on issues currently surrounding the notions of teacher competency and CBTE must begin anew in both its questions and approach.

Many people assume the CBTE orientation inherently will produce "competent" and "effective" teachers whereas previous orientations may have failed to do so. Others, critics of the movement, perceive the unreality in these expectations and condemn CBTE because it will not yield magical results and may have additional negative side effects. The irony of these two positions is that they are often rooted in the same research evidence.

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Although prior research on teaching and learning (Gage, ed., Handbook of Research on Teaching, 1963; Travers, ed., Second Handbook of Research on Teaching, 1973) may have stimulated the development of CBTE indirectly by indicating the general ineffectiveness of existing teacher education procedures (Bellack et al., 1966; Hoelker & Ahlbrand, 1969, descriptions of teaching) and by pointing out new direction and technologies such as microteaching, minicourses and interaction analysis observation systems, that research was not designed to resolve current philosophical arguments about CBTE nor fill its knowledge gaps. Neither was it designed to verify its assumptions or effectiveness.

The surprisingly quick adaptation of competency-based design and training procedures by numerous teacher educators and State Departments of Education in spite of an inadequate research basis for many of its program development tasks probably reflects the extent of dissatisfaction with existing procedures and the sense that enough elements were available to build CBTE models. Leslie White in the Science of Culture points out that new inventions are made when most of their necessary elements exist in the culture awaiting synthesis.

The reality of teacher education is that the field is already committed and deeply involved operationally in the phenomenon of CBTE. Our stance is that we must now examine CBTE on its own terms, framing research questions and selecting designs which test the stated and implicit assumptions underlying CBTE models. To do this we must assume the specification of competencies and ask the question "How does Competency Behave?" rather than "What is Competency?" We

must also recognize, as Fuller (1975) points out, that despite the fact that teachers have been trained for many years and educational researchers have long been analyzing teacher effectiveness and teacher characteristics, we know very little about the experience of learning to teach or of teacher education as process of intervention. It would seem essential to gain a more basic understanding about the phenomenon of training before aborting or heralding any one set of design principles. Initial research into training should be similar in intent to anthropological research and naturalistic, descriptive and developmental in its approach.

In addition to the need for more systematic exploration of the training process itself, this research is prompted by a concern for more powerful and functional ways of conceptualizing individual differences and their role in training. While we are inclined to believe that CBTE designs probably yield more efficient, effective training, we also know from experience, if not from research, that teachers do have different personalities and teaching styles and that they do perform differentially in their training roles <u>even after</u> exposure to highly behavioral training procedures. Some people would view this phenomenon and the sanctity of individual differences as grounds for rejecting competency-based training. On the contrary, we feel what is needed is a fresh research perspective on competency-based education issues, one that is rooted in the actual training experience and in the description of individual differences. Instead of accepting a priori the assumptions that individual differences don't matter or

that they do exist and therefore the training model is inappropriate, we hoped to develop more complex and relevant ways to conceptualize teacher style and personality variables so that their inevitable effect on competency acquisition and learner outcomes can be adequately mapped.

The present research reflects our concern then, to bring together the foci of individual differences in teacher trainees and the developmental study of training with the assumptive world of CBTE. Research and development were undertaken which would:

1. produce a behavioral typology of teacher trainee learning styles;
2. track the development of competency over the period of training;
3. ascertain the development of competence in different areas of performance and its relationship to teacher trainee learning style;
4. assess the influence of trainee learning style on pupil outcomes.

The research is divided into two parts; Part I is concerned with the developmental study of teacher training and Part II with the influence of teacher trainee learning style on the development of teacher competency. Part I presents a descriptive profile of the development of teacher competency and explores the following questions:

1. What levels of competency are attained?
2. How does the development of preactive competency (planning instruction) compare to the development of competency in implementing instruction (performance)?
3. How does the terminal level of competence differ from entry behavior? from minimal competence?

4. How consistent are teachers in an area of competence?

5. What are the relationships among so-called "criteria of competence"?

6. How do practice and model influence the level of competence?

The question examined in Part II is "How do trainees of different learning styles differ in their response to training?" More specifically, in terms of their (1) acquired level of competence in planning and performance; (2) predisposition for different models of teaching; (3) performance improvement; and (4) influence on pupil learning.

The Assumptive World of CBTE

CBTE rests on many assumptions, several of which are of particular concern in this research. The first is that competencies can be defined and measured. To some extent definition and measurement of competence appear to be conceptually related or at least indistinguishable in the CBTE literature. Turner, for example, speaks of six levels of criteria for teacher performance. These range in a hierarchy with competency respectively as knowledge, teaching performance under increasingly complex conditions and finally, effect on pupil outcomes (Rosner, 1973). Others have seen the attainment of competence in terms of percentage of correctness on a particular behavior, presumably irrespective of the type of competency such as knowledge or demonstrative and of the simplicity or complexity of the behavior. A second and related assumption is that discrete

competencies combine into more complex behaviors and levels of competence. Thus there is a presumption of essential linkage among various competencies or sets of competencies.

The second assumption emanates from a consideration of the nature of teaching as an activity and its organization into generic categories of behaviors, which combine to produce a whole-task, continuous performance (Weil, 1975; McDonald, in Houston, 1974). It is possible to view Turner's levels as related segments of the teaching act. Many CBTE designs, as well as their predecessors, fragment the teaching act so that the knowledge competencies are substantively unrelated to performance competencies and teaching performance behaviors are functionally unrelated to one another. In some cases, only knowledge level competencies are defined and instructed for, with actual teaching performance left unconceptualized. The view of teaching (or competence) taken in this research combines Turner's concept of criteria of competence with a cybernetic theory of behavioral organization. Thus, the areas or aspects of competence that are investigated are (1) knowledge of theory; (2) planning instruction; (3) teaching performance in teaching strategies and their related teaching skills (not reported in these data); and (4) pupil output. Because of the influence of Turner's criteria on the thinking of the field and the attraction of pupil output as a measure of competence, we were particularly interested in investigating the relationships among the so-called criteria of competence and organization of behavior.

A third, albeit implicit, assumption is that teacher performances are stable over time. Consequently it is possible to have confidence in the concept of competence. If the third assumption is true, measurements of competence should be relatively stable.

These first three assumptions pertain to the nature of competence; the fourth concerns trainability. The competency-based stance tends to assume that every teacher trainee is trainable to all teacher behaviors regardless of teacher style or personality. Although studies about specific training procedures or skill training do exist, especially in product testing research, few studies focus on learners' responses to training, on the longitudinal process of learning how to teach or on the acquisition of one complex behavior. From related research we know teachers have different types of personalities Washburn & Heil, 1960), different conceptual systems and modes of processing information (Harvey, Hunt, & Schroder, 1961; Hunt, 1971), and different teaching styles. It is reasonable to assume that individual differences such as these do affect the process of training and measures of competence.

In the Teachers College Elementary Preservice training program, the authors and other staff members had for several years observed both differential response patterns and regularities among sets of trainees. In this study an attempt has been made to classify these observations into concepts of Teacher-Trainee Learning Style and to examine the effects of trainee learning style on the acquisition of competency.

The remainder of the report is organized into the following sections: (1) the theoretical background of the study including a description of the research setting and design, the Models of Teaching Program and its concept of competency, and the Profile of Teacher Trainee Learning Styles; (2) results of the Developmental Study of Teacher Competency; (3) results of the influence of Teacher Trainee Learning Styles on Competency Acquisition.

Theoretical Background

Research Setting and Design

This study was conducted over a nine month period of time in the context of the regular Teachers College Preservice Program for Elementary Teachers. The three divisions of the study as they occurred are:

Months One through Six: Developmental Study of Competency

Entire Nine Months: Construction of Teacher Trainee Learning-Style Profile

Months Eight and Nine: Experimental Study of Teacher Competency and Pupil Outcomes

Except for the experimental study of teacher's learning style on pupil learning, all data were collected in the natural setting and ongoing teacher training program.

The conceptual framework of the program is based on the Models of Teaching (Joyce & Weil, 1972; Joyce, Weil, & Wald, 1973). A Model of Teaching is a theoretically-based strategy for instruction and for curriculum design. Teacher trainees in exploring alternative

models of teaching consider a model first as a philosophy of education and theory of learning or instruction, then as a complex teaching performance behavior in which they interact directly with pupils using the teaching strategy. While mastering the strategy, the teacher candidates also become aware of and acquire the teaching skills, the micro-behaviors, that facilitate excellence in a model. Towards the latter part of training, after trainees have mastered a repertoire of teaching strategies and their related teaching skills, they undertake larger segments of instruction, designing curriculum units. In that activity models serve as principles of design and a means of conceptualizing instruction over longer periods of time.

Acquiring teaching performance competency in a model occurs in several stages. Training in model-related skills can take place concurrently with training in the model using the same instructional sequence. A summary of the instructional sequence is shown in Figure 1. These training stages correspond roughly to Turner's criteria of knowledge and teaching performance. Knowledge, in the context of a model of teaching, is seen as knowledge of theory as well as ability to apply the theory in planning instruction. Although learning outcomes are theorized for each model of teaching, competency in a model has not traditionally been assessed in terms of pupil outcomes. For purposes of this research a special experimental study was conducted in order to assess the relationships among a wider range of competency criterion and of the effect of time.

	Model of Teaching	Related Teaching Skills
I.	Knowledge of Theory of the Model	Knowledge of the Skill(s)
II.	Demonstration of the Lesson	Demonstration of the Skill(s)
III.	Planning a Lesson Using the Model	Planning
IV.	Peer Teaching the Planned Lesson	Peer Teaching using the Skill(s)
V.	Microteaching	Microteaching
VI.	Application of the Model in the Regular Classroom Context	

Figure 1

Instructional Sequence for Performance Competency

Twenty-two teacher trainees were enrolled in the Preservice Program in Elementary Education and served as subjects in the developmental training study and as the basis for constructing the Teacher Trainee Learning Style Profile. Eight of the teacher trainees participated in the experimental study of pupil learning, providing instruction for sixty pupils from a nearby suburban school.

The developmental data on teacher competency, indicated by performance on three models of teaching, were collected as part of the program requirements. After extensive training in a model, teacher trainees planned model lessons and taught the model three times (three different lessons) to small groups of pupils. These

microteaching sessions were video-taped or audio-taped and assessed jointly by the trainee and an instructor for planning and teaching competency using clinical assessment measures, developed from previous Models of Teaching studies. These measures consist of low inference items designed to reflect the theory and behavioral specifications of a model (see Appendix A).

The Teacher Trainee Learning Style Profile was developed from instructors' observations of teacher trainees in different training situations. Highly discrete behaviors were taken as indicators of learning style. On the basis of these behavioral indicators, four learning styles were identified. A trainee's learning style is determined by the composite of responses in eight typical training situations. The Trainee Learning Style Profile indicates the characteristic response expected of each style to each of the eight training stimuli.

Finally in the experimental study conducted during the spring, two teacher candidates representing each of the four trainee learning styles taught two lessons using the Concept Formation Model. Prior to teaching, teacher trainees were given a test on their knowledge of the theory of the model. Their lessons were assessed for planning competency and teaching competency. Measures of pupil learning for recall and concept attainment, a model-related outcome, were obtained.

A summary of the three divisions of the study, their general design and outcome measures, appears in Figure 2.

	Research Emphasis	Time	Measures
1.	Developmental Study of Training	September-March	Planning Competence: Inductive Teaching Model (Trials 1, 2, 3)
			Planning Competence: Synectics (Trials 1, 2, 3)
			Planning Competence: Role-Playing (Trials 1, 2, 3)
			Teaching Competence: Inductive Teaching (Trials 1, 2, 3)
			Teaching Competence: Synectics (Trials 1, 2, 3)
			Teaching Competence: Role-Playing (Trials 1, 2, 3)
2.	Development of Typology: Teacher Trainee Learning Styles	September-April	Description of Four Teacher Trainee Learning Styles
3.	Experimental Study	May	Knowledge of Theory
			Planning Competence: Inductive Teaching Model (Trial 1 and 2)
			Teaching Competence: Inductive Teaching Model (Trial 1 and 2)
			Pupil Learning Outcomes: Recall, Concept Attainment (6 subscores)

Figure 2

Design of the Study: An Overview

Due to the limited number of subjects in this initial study results from this research must be interpreted with some caution. We prefer to view this study as exploratory and indicative of a productive direction for research into the notions of competence and trainee learning styles. Along these lines, research is presently being pursued into the question of trainee learning styles in a larger sample of five teacher training programs in the Northeast (Ellis, 1975).

The Models of Teaching Concept of Competency

This study is part of the ongoing work in the development of behavioral models of teaching. Previous studies by Joyce, Weil, and others have indicated that it is possible to train teachers to different models of teaching requiring them to train teachers to different models of teaching requiring them to manifest wide differences in teaching style. Those findings were particularly significant in light of knowledge about the prevalence of a behaviorally restricted, lecture-recitative teaching style. More recent studies indicate that the models do boost pupil outcomes in predicted directions and that pupils can be taught to perform these models independent of teacher direction (Hunt et al., 1974).

Whereas previous training studies in Models of Teaching were concerned with the ability to acquire minimal competency in a model, this study looks at the developmental process of acquiring competence in models and the relationship of different aspects of levels of competency as well as the effect of individual differences.

Models of Teaching represents an attempt to operationalize a particular theory of learning or philosophy of education into a pattern of activities that teachers can be trained to perform. In the course of these activities, teachers and students may engage in hundreds of interactions. Teaching skills, in contrast to teaching strategies or models, are smaller, more discrete units of teaching, often a single teacher move. Models differ from one another not only in terms of the nature and pattern of their activities but also in terms of the teaching skills associated with those activities.

Competency in a model is a competency of a complex teaching performance (demonstrative) behavior. It is assumed that knowledge of the model's theory and the ability to plan instruction for a particular model and to execute the teaching skills are associated with but not synonymous with competency in a model.

Models are described in terms of their (1) syntax or phases of activities; (2) principles of reactions, guides for gauging and selecting responses to what the learner does, i.e., model-specific responsive skills; (3) the social system, student-teacher roles, authority relationship and norms; and (4) support systems, the necessary material, technological or human facilities. Clinical assessment of model performance is based on the presence of behaviors that carry out these specifications (see Appendix A). A notion of minimal competency might refer to the general presence of the phases of activity in their specified sequence whereas terminal competency would be sensitive to the presence of specific general and model-related skills.

In this study acquisition of competency is examined for three models of teaching: Inductive Thinking, Synectics, and Role-Playing. Inductive Thinking is a three phase model designed to help students form concepts inductively. It is based on Bruner's theory of concepts (Bruner et al., 1967) and Taba's formulation of a concept formation strategy (Taba, 1966). Synectics is a model to develop creativity through the use of metaphoric activity (Gordon, 1961). Finally, Role-Playing, extrapolated from the work of Fannie and George Shaftel, helps students develop empathy, determine the consequences of their behavior, explore alternative solutions to problem situations and analyze their feelings and values.

The Profile of Teacher Trainee Learning Style

The origin of the learning style profile was the Preservice staff's desire to codify perceived regularities in trainee reactions that we had observed for several years. While each trainee is unique in his needs, responses and style, there were commonalities among the responses of individual trainees. We wondered if it were possible to identify characteristic learning styles that transcend the idiosyncratic behaviors. The work of Washburn and Heil (1960), Peck (1960), Harvey, Hunt, and Schroder (1961), and Hunt (1971) supports this notion. These authors maintain that teaching behavior and learning styles fall into distinct categories, each suggestive of a general personality structure.

Although the leap to inferences about personality structure

or traits was tempting, we were not as interested in the underlying dynamics as in the patterns of observable differences and their relationship to various training situations and to training outcomes. For our purposes it was important, therefore, that the conceptualization of learning styles be derived directly from the training situation itself rather than from a theory of personality. We assume that the range of settings and activities teacher trainees encounter taps a complex configuration of personality dimensions and traits.

A second criterion was that the classification be based on readily observable (low inference) behaviors. High reliability and ease of usage were important shaping forces in the final descriptions of the learning styles.

The classification of learning styles is based on a trainee's responses in four settings, typical of most teacher training programs. Each setting has one or more stimulus situations. The four settings and their related stimulus situations appear in Figure 3. Definitions of each setting and stimulus can be found in Appendix B.

Anecdotal records were compiled describing the behavior of the twenty-two trainees in the eight stimulus situations. On the basis of these observations four distinct categories of teacher trainees emerged. These are described at length in an unpublished manual (Weil et al., 1974). A description of the four learning styles (adapted from Ellis, 1975) appears below. These descriptions are the specific behaviors that occur in the training settings and situations. For purposes of Ellis' work some inferences about the

I. Instructional Setting	1. Response to Instruction 2. Cognitive Orientation
II. Classroom Teaching Behavior	3. Planning Skills 4. Structuring Skills 5. Response Style
III. Supervisory Conference	6. Reaction to Correction Feedback 7. Orientation to Behavioral Analysis
IV. Professional Relationship	8. Relationship with Cooperating Teachers

Figure 3

Setting and Stimuli for the Determination of Teacher-Trainer Learning Styles

meaning and motivations of the behaviors have been drawn. A summary of characteristic responses to each stimulus can be found in Appendix C.

Style I

Type I teacher trainees are highly verbal and participate frequently in class discussions. However, frequently their contributions are off the topic and appear to function as attention-getting devices. Type I's often tell personal anecdotes. They enjoy having attention focused on them and seem restless and uninterested when it is not. This type rarely comes to class prepared; consequently they have difficulty maintaining the group's attention through intellectual contributions to the discussion. Type I's often utilize non-verbal gestures such as eating, raising eyebrows to express disapproval, and leaving the room. Type I's are very theory-oriented but do not show clear understanding of the theories to which they refer, and resist all new theories presented in class. They frequently are negative about an idea without being precise about why they disagree. Type I's avoid planning instruction, do not understand or use structuring moves in interaction with pupils and oppose structure on philosophical grounds. They cannot see any relationship between their lack of structuring and subsequent management problems, and resist the connection when it is pointed out. If asked for an assessment of their teaching, Type I trainees search for reasons external to their own behavior to explain the events occurring in a lesson. Their responses to children are inconsistent and indiscriminant and

they frequently violate the norms of the classroom in which they student teach. If they have success as student teachers, it is likely to be in a tutorial setting in which management problems and need for structure are minimized.

Style II

Type II trainees come well-prepared to instructional sessions, taking notes in class and in conference sessions, and are able to refer later to what they've read and written down. This group is interested in new theories and show evidence of trying to incorporate them into their own understanding and behavior. Type II's can make use of various theoretical frameworks, can reorganize curriculum materials to fit a particular framework or strategy, and can interpret what happens in a classroom from a theoretical framework. They plan thoroughly for their teaching, often writing in their plans the actual words used to structure a lesson. Type II's are clear about their intent, and they structure intuitively. They are not rigid, however, and can use negotiated structure. Type II's are receptive to substantive feedback from their supervisors, and actively participate in the evaluation of their student teaching. They respond to children with what appears to be genuine warmth; they use positive feedback and are obviously receptive to children's ideas, redirecting or refocusing any irrelevant pupil statements in an accepting and supportive manner. Type II's get along well with their cooperating teachers, and are given significant responsibilities in the classroom.

Style III

Type III trainees prefer the concrete to the abstract, and ask closed-ended, practical questions. Because they are concerned with the management of the classroom--with "how-to-do-it"--Type III's respond best to instructional sessions that include demonstrations. In their opinions they frequently identify with or cite the position of an authority figure. Type III has difficulty comprehending theory through reading and prefers to learn by observing and imitating a model. Such imitation involves little flexibility, however; Type III's tend to learn something in one situation and rigidly transfer that behavior to a completely different situation. Their planning for teaching is sparse, and they exhibit poor instructional design skills with little attention to details. Although Type III trainees enter the program with poor interactive structuring skills, they are receptive to the need for structure in the classroom and make rapid progress in learning structuring moves. (This behavior is consistent with their interest in organizational and managerial skills.) They also progress from an apologetic stance vis-a-vis their student teaching to a more confident, inquiring attitude in supervisory conferences. However, they continue to look to their supervisor for guidance and approval, and they do not initiate evaluative comments about their teaching. Type III's also exercise little initiative in the classroom

and require specific instructions from their cooperating teachers. They are responsible about following instructions when given, however. Type III's responses to children appear mechanistic and uncertain. They seem more concerned with the lesson in their own mind than with what the children are saying, and have difficulty integrating the two. They may cut off a student response if it is not what they anticipated, or they may allow a digression to occur with no apparent understanding of how to redirect the students' attention. Type III's do not improvise, and have difficulty responding to unexpected events.

Style IV

Type IV trainees tend to withdraw from instructional sessions, refusing to participate and coming unprepared. Although they will respond to theoretical points, they reject theory as irrelevant. Type IV's are very interested in instructional materials and tend to collect these through the training year. Often Type IV's seek and develop friendly relations with their instructors even as they reject or ignore the substance of the class. Type IV's avoid peer teaching and sharing tapes of their student teaching. In the classroom they use structuring moves intuitively, but are comfortable only when they control the structure. Their orientation is toward the future (their first year as teachers) and its problems; they exhibit little interest in learning for learning's sake. Type IV's often leave during a discussion which they see as having no relevance for them, or which makes them uncomfortable. Their participation in supervisory conferences is limited to attendance and passive responses; they do not seek evaluation of the student teaching, nor do they offer any. Type IV's plan thoroughly for their teaching, maintain firm control in the classroom, and do not tolerate digressions and discrepant events. They make little use of student ideas, and their positive feedback to students often sounds mechanistic and insincere. However, their cooperating teachers find them responsible and capable. In general Type IV trainees avoid contact with peer groups, maintain strict control when teaching and rely heavily on materials.

The classification of learning styles has not been validated in with larger samples and other types of programs. Ellis, in her study (in progress) has designed a questionnaire based on the descriptions of the four learning styles which she is collecting on sixty teacher trainees in five teacher education programs. One of the purposes of Ellis' study is to validate the existence of the four styles.

Part I: Developmental Study of Teacher Competency

Development of Competence in Three Models

Four questions posed earlier in this paper regarding the developmental study of teacher competency will be reported together. The questions are:

1. What levels of competency are attained?
2. How does the development of preactive competency (planning competency) compare to the development of competency in implementing instruction (performance competency)?
3. How does the terminal level of competence differ from entry behavior (level of competence) or minimal entry competence?
4. How do practice and model influence the level of competence?

Two sets of concepts assisted us in the analysis, interpretation and presentation of these data. These include Planning Performance and Teaching Performance, and the notions of minimal entry level competency and minimal terminal level competency.

Data in planning performance and teaching performance by trainees in each model (Inductive Thinking, Role Playing, and Synectics) are presented separately for each model. No pre-assessment of entry level performance ability was made, since each model calls for the integration of a complex set of teaching skills which reflects knowledge of and the ability to operationalize a particular theory of learning. In place of an entry level pre-assessment (which would be based on no knowledge, training or practice), the Preservice program had established a minimal entry competence level expected

as the result of training in knowledge, demonstration, planning, and peer teaching, which was assessed after the first microteaching lesson. This measure, although different for each model, refers to the general presence of the phases in their specified sequence along with essential, model-relevant teaching behaviors as extrapolated from the Clinical Assessment instrument for each model. A second level, known as a minimal terminal competency, was established for each model and includes the criteria for minimal entry level competency along with the addition of other model-related moves (skills) which indicate increased competence in the use of the model. These minimal and terminal competency levels appear below in Table 1.

Table 1

Competency Levels for Three Models of Teaching

	Minimal Entry Level Competency	Minimal Terminal Level Competency
Inductive Thinking	56.25%	81.25%
Synectics	65.38%	80.77%
Role Playing	56.82%	79.55%

After the presentation of data on the acquisition of competence in the three models, we will explore the question "How consistent are teachers in an area of competence?" A series of analyses will address the issue of consistency, first in a single area of competence (such as planning or teaching) within each model and then consistency in

planning or teaching across the three models. Finally, we address the question "What are the relationships among different criteria of competence?" Fall data regarding the relationship between planning performance and teaching performance in three models are reported followed by the results of our analysis of the relationship between knowledge of theory, planning performance, teaching performance, and pupil outcomes based on data collected from the experimental Spring Research using the Inductive Model.

Industice Thinking. The models are reported in the order in which they were performed by the Preservice students. Results of training on the Inductive Thinking Model, which is a three phase, teacher-directed, content-oriented model, are reported in Figure 4. However, a summary of levels of competence on all trials for all three models appears in Table 2. This table will be referred to throughout the discussion of each model.

The general Preservice population attained a high level of planning performance in the Inductive model, entering at a level of 75.60% and rising to above 90% in both trials two and three. Variability in planning decreased from trial 1 to trial 2 (26.14%-9.31%) but increased again in trial 3 (9.31%-21.3%). The planning for the Inductive Thinking model is integrally related to both the theory of the model and the content of the lesson. The teacher must specify learning outcomes, key concepts and their attributes, and the questions which he/she could use in each phase to elicit data

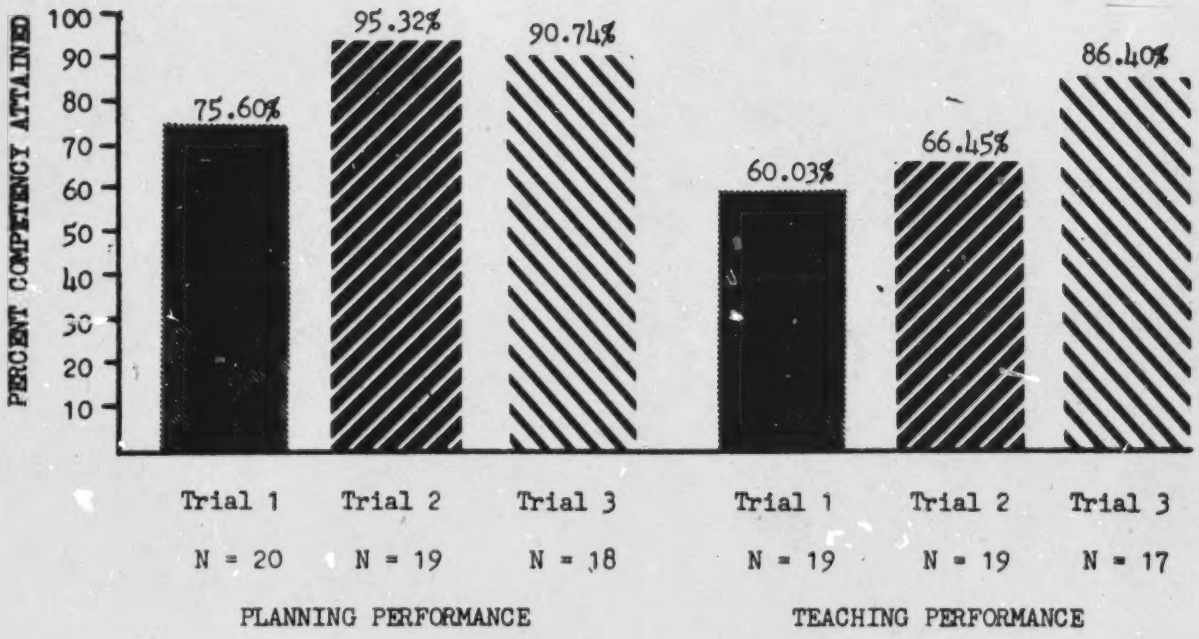

Figure 4

Level of Competency Attained
(Inductive Thinking Model)

related to the concepts and attributes. Changes in content of the lesson probably affect the teacher's planning competence more in this model than in others and may account for some of the instability in planning competence.

The entry level teaching performance attained for trial 1 of this model was 60.03%, which is comfortably above the minimal entry competency level shown in Figure 4. The effect of practice from trials 1 to 2, and 2 to 3 is to raise the level of competency attained to 86.40%, well above the minimal terminal competency level established (81.25%). A t test indicates the gain in teaching performance between

Table 2

Levels of Competency Attained

	Inductive Model				Synectics Model				Role Play Model			
	Planning		Teaching		Planning		Teaching		Planning		Teaching	
	% Comp.	S.D.	% Comp.	S.D.	% Comp.	S.D.	% Comp.	S.D.	% Comp.	S.D.	% Comp.	S.D.
Trial 1	75.60	26.14	60.03	21.51	53.97	18.41	78.39	16.96	86.63	22.55	68.80	23.92
Trial 2	95.32	9.31	66.45	16.17	59.52	22.90	80.57	13.58	88.54	24.16	66.75	25.26
Trial 3	90.74	21.30	86.40	13.84	57.41	21.62	84.62	16.05	95.82	6.75	72.25	21.85

trials 1 and 3, the variability among the group decreases, as one expects under the assumption of CBTE. The effects of practice in both planning and teaching performance is to raise the level of competency over the three trials of this model with a significant improvement in teaching performance noted.

Synectics. The second model reported is the Synectics Model, a six phase process-oriented, student-negotiated strategy. This model is the least complex of the three because the teacher does not have to integrate content or adapt to pupil's ideas. Her role is a facilitative one, seeing to it that students move through all the phases of metaphoric activity. Figure 5 below indicates the levels of competency attained in planning and teaching the Synectics model. One can quickly note that planning performance was inferior to teaching performance and that this remained a consistent pattern across the three trials.

Many students did not use the specified planning forms, turning in their own, more general planning form. Since this was a process-oriented model, it may be assumed that careful planning is not viewed as essential to teaching performance as is the case in other, more content-oriented models. Approximately one third of the students who taught the model failed to turn in any planning forms. We have no idea why this is the case and can only speculate as to the reasons. Planning performance on trial 1 was 53.95% and never rose above 59.46% in trial 2. Repeated planning attempts do not seem to indicate any increased ability.

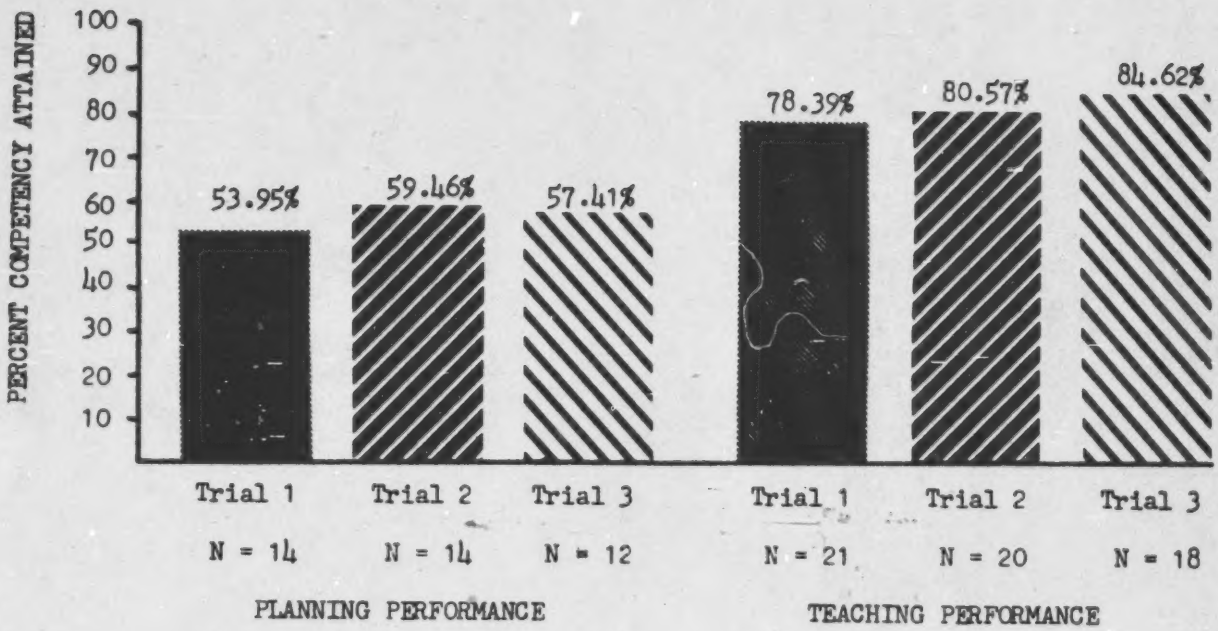

Figure 5

Level of Competency Attained
(Synectics Model)

On the other hand, teaching performance does not seem to have been hampered by poor planning performance (or poor program management). In all three trials, the general Preservice population performed well above the minimal entry level competency of 56.82% and in trial 3 performed above the minimal terminal level of 80.77% rising to a level of 84.62%. What is of particular interest, here, is the fact that the initial competency level in trial 1 is much higher than the initial competency level in trial 1 of the Inductive model. It is the researchers' feelings that this may be due to a combination of the socialization to training in models, the less complex nature

of the Synectics model, and the natural maturation of teaching competence.

Role Playing. The third model reported in this study is the Role Playing Model, a model with foci in both content and process characterized by elements of both teacher direction and student negotiation. It is a very complex nine phase model. Figure 6 shows clearly that trainees' ability to plan for this model is superior to their ability to teach the model. Planning performance in trial 1 is 86.63% and steadily increases from trial 1 to 2, and 2 to 3 to a level of 95.82%. Because this is a highly complex, content-oriented model, the authors feel that planning competence is probably viewed by students as more essential to success in this model. It is interesting to note that as planning performance rises to its highest level (95.82%) variability on planning performance decreases (see Table 2).

The terminal level of competency attained in teaching performance for this model is low in comparison to previous models. The general population attains a terminal competency level of only 72.25%, despite an entry level of 68.80% in trial 1. The low level of competency in this model is partly explained by examining the variability, which remained large throughout all three trials (see Table 2). Of the three models, Role Playing is the most complex and difficult to perform, perhaps beyond the reach clinically of some students at this point in their training. It is further worth noting that the general

population, while improving their performance with practice, did not reach the terminal level of competency of 79.55%.

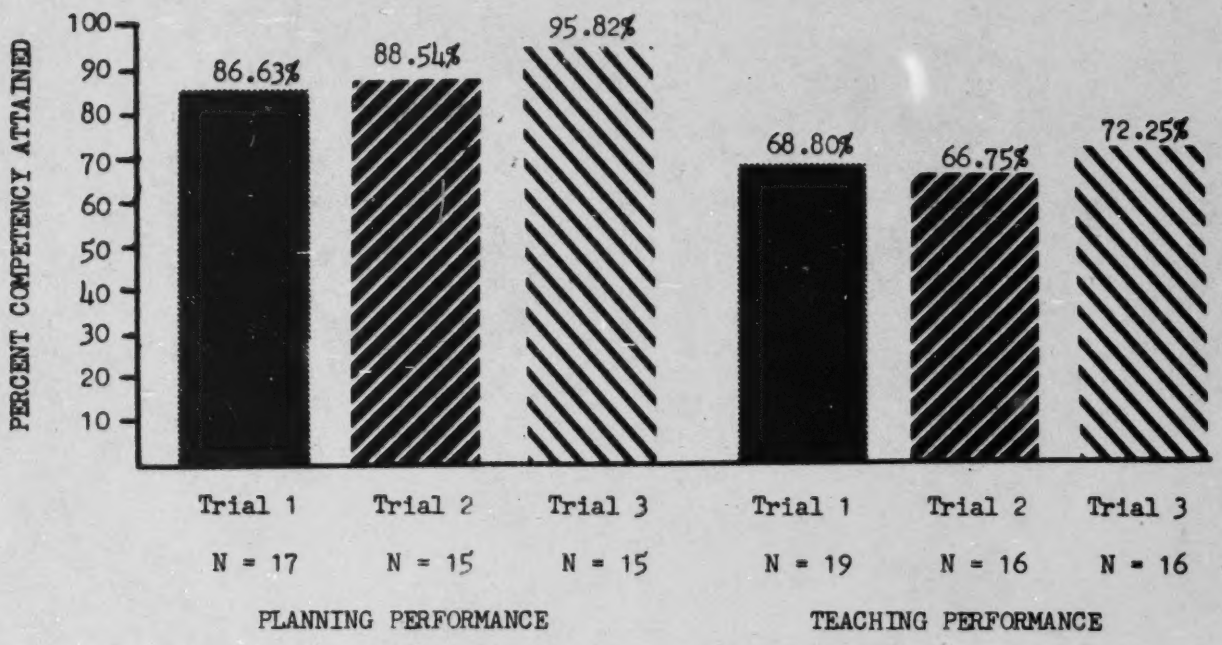

Figure 6

Level of Competency Attained
(Role Play Model)

Consistency of Competence in Planning and Teaching Behavior

The question addressed in this section is whether individual performances are stable over time. Put another way, is the relative level of competence of individuals within a group consistent within and across both skill areas and models? Consistency is indicated by a significant correlation in the ranks of individuals on each set of training variables using Kendall's Rank-Order Correlations.

To help us interpret the patterns of consistency where they appear, we refer to the concept of stability of competence. Stability in this sense refers to the trial which shows greatest improvement (gain scores) for that model for the group as a whole. Thus, there may be consistency of performance among individuals but this consistency may appear before the point where the level of competence for the group appears to be stabilized.

Consistency of planning competence within models. The correlations between individual planning performances within three trials of a model appear below in Table 3.

According to Table 3, there does seem to be consistency of individual performances within models; however, the pattern of consistency vis-a-vis stability seems to vary according to the nature of the model. For example, in both the Inductive Thinking and Synectics models, a stabilization of planning ability appears to occur at the second trial with the greatest increase in group means occurring between trials 1 and 2. (See Table 2.) In the Role Playing model, there is consistency between an individual's performance in the first and second trials but not between the second and third trials, where the greatest improvement is found. In other words, in Role Playing where consistency appears the final level of competence has not been reached. Apparently, with training the rank order of performance changes.

Table 3

Consistency of Planning Competence Within Model:
Results of Rank Order Correlation

	Inductive Thinking Model			Synectics Model			Role Playing Model		
	Trials (Fall)			Trials (Fall)			Trials (Fall)		
	1	2	3	1	2	3	1	2	3
Trial 1									
Trial 2	(19)[a] .2879**			(13) .4299**			(14) .8506**		
Trial 3	(17) -.0744	(16) .3925**		(10) .3078	(10) .8149**		(14) .1255	(14) .0273	

[a]Number in the population

*Indicates significance at the .05 to .01 level

**Indicates significance at the .01 to .001 level

The pattern of consistency within the Inductive Thinking and Synectics models are very similar. In both models there is a significant correlation between planning performance on the first and second trials and between the second and third trials, with the correlation being of greater magnitude between the second and third trials. (Significant at the .042 level between the first and second trials, significant at the .017 level between the second and third trials in the Inductive Thinking model, and significant at .020 to .001 levels in the Synectics model.) This indicates that the general population reaches consistency of planning performance by the second

trial of the two models. This is also supported by the pattern of increase in general population means between trials. There is about a 20% increase in means from the first to second trials of the Inductive Thinking model with about 4% decrease from the second to third trials (see Table 2). Thus, in both models, practice and supervision show the greatest effects on individual performance between the first and second trials and there is a stability of competency from the second to third trials.

The pattern of consistency in planning performance in the Role Playing model differs from the patterns found in the Inductive Thinking and Synectics models in two ways: (1) while there is a significant correlation between performance on the first and second trials, there is no correlation between performance on the second and third trials, and (2) the effects of practice and supervision on planning performance are not much in evidence between the first and second trials, but strongly in evidence between the second and third trials. Thus, the stability of competence after the second trial, found in the Inductive Thinking and Synectics models, does not hold true for the Role Playing model with regard to planning performance.

In summary, it appears that consistency of planning ability within a model varies according to the nature of the model in terms of the trials in which practice and supervision are most strongly in evidence and the trials in which stability of performance is reached.

Consistency of planning competency across models. The levels of significance for correlations between individual planning performances across three trials of three models appear below in Table 4.

Table 4

Consistency of Planning Competency Across Models: Results of Rank Order Correlations

Thinking Model Fall Trials	Synectics Model Trials 1	Synectics Model Trials 2	Synectics Model Trials 3	Role Playing Model Trials 1	Role Playing Model Trials 2	Role Playing Model Trials 3
1	(14)[a] .0676	(14) .1462	(11) -.0949	(17) .3282*	(15) .1242	(15) -.2934
2	(14) .2394	(13) .4369*	(11) .2980	(16) -.2595	(14) -.1636	(14) .1680
3	(12) .2385	(13) .4212*	(10) .5418*	(15) .0493	(14) .4178*	(15) .2268

[a]Number in the population

*Indicates significance at the .05 to .01 level

If we accept the trials in which some stability of planning performance is reached (stability meaning a leveling off of gain between trials) as an indication of the individual's planning ability, we would predict certain correlations in order to infer a general planning ability for individuals across models. The following correlations could be expected on the basis of the finding that planning performance stabilizes at different levels in different models: (1) trial 2 Inductive Thinking with trial 2 Synectics;

(2) trial 3 Inductive Thinking with trial 3 Synectics; (3) trial 1 Inductive Thinking and Synectics with trial 1 Role Playing; (4) trial 3 Inductive Thinking and Synectics with trial 2 Role Playing. In fact, four of the six relationships were significant.

The second trial of Inductive Thinking was consistent with the second trial of Synectics and the third trial of Inductive Thinking was consistent with the third trial of Synectics. (The correlations were significant at the .019 and .015 levels respectively.) Thus, in the two models in which the patterns of consistency and stability were the same, we find consistency across the two models in terms of planning performance.

In the Role Playing model in which there was stability of performance between the first and second trials but not between the second and third trials, we would expect that the trials in which there was stability or consistency of performance to be correlated to the Inductive Thinking and Synectics trials in which there was indication of stability and consistency. We found that the first trial of Role Playing and the third trial of Inductive Thinking is consistent with the second trial of Role Playing. The third trial of Role Playing, in which the stability of performance decreases considerably, is not correlated with any trials of the other models.

Thus, if we take the trials in which there is stability and consistency of performance as an indication of the individual's planning ability, there does seem to be some consistency of individual performance across models from which we might infer a general planning

ability. In other words, although planning performance stabilizes at different trials in different models, there is indication of a general planning ability which is consistent across the three models.

Consistency of teaching competence within a model. The levels of significance for correlations between individual clinical performances within three trials on a model appear below in Table 5.

Table 5

Consistency of Teaching Competence Within a Model: Results of Rank Order Correlation

	Inductive Thinking Model			Synectics Model			Role Playing Model		
	Trials (Fall) 1	2	3	Trials (Fall) 1	2	3	Trials (Fall) 1	2	3
Trial 1									
Trial 2	(18)[a] .6305**			(20) .1994			(16) .6325**		
Trial 3	(15) .2420	(15) -.0547		(18) .2290	(18) .1330		(16) .3798**	(13) .4774**	

[a]Number in the population

**Indicates significance at the .01 to .001 level

It appears that an individual's consistency of clinical performance within a model varies according to the relative complexity of the model and its entry level of competence.

In the Inductive Thinking model there is a consistency between

the first and second trials and no consistency between the second and third or first and third trials. The Inductive Thinking model is the first model attempted by the teacher trainees at the beginning of the program; therefore, entry level skills are lower than for the other two models which follow. It is interesting to note that the general population means increase only about 6% from the first to the second trials and about 20% from the second to third trials. It appears that in the Inductive Thinking model which is fairly complex, the effects of supervision and practice are most strongly in evidence between the second and third trials. This would alter the rank correlation so that for the Inductive Thinking model initial competence did not predetermine final competence. This finding may not hold if Inductive Thinking model were taught later in the training program.

No consistency of performance was found between the three trials of the Synectics model. This model was taught after the Inductive Thinking model. In comparison, it is a relatively simple model to operationalize because it is primarily a process model; the substance is controlled by the students. It is likely that the carryover of skills from the Inductive Thinking model in combination with the relative simplicity of the Synectics model increased the level of entry performance for most trainees above the entry level behavior and just below minimum terminal competency. Synectics probably does not discriminate generic competence as much as the other models.

Consistency of teaching behavior across models. The levels of significance for correlations between individual clinical performances across three trials of three models appear below in Table 6.

Table 6

Consistency of Teaching Competency Across Models: Results of Rank Order Correlation

Trials (Fall)	Synectics Model Trials 1	Synectics Model Trials 2	Synectics Model Trials 3	Role Playing Model Trials 1	Role Playing Model Trials 2	Role Playing Model Trials 3
1	(19)[a] .3067*	(18) .4731**	(16) .3737*	(18) .4548*	(15) .3301*	(15) .3421*
2	(19) .4232**	(19) .2302	(17) .3886*	(18) .2458	(15) .1124	(15) .3703*
3	(17) .3617*	(17) .2848*	(15) .0115	(16) .4202*	(14) .4441*	(15) .4042*

[a] Number in the population

*Indicates significance at the .05 to .01 level

**Indicates significance at the .01 to .001 level

In contrast to the finding that the patterns of consistency within models varies with each model, we find a great deal of individual consistency in clinical performance across models. Performance in the first trial of the Inductive Thinking model is correlated with performance in every trial of both Synectics and Role Playing. Performance in the second trial of Role Playing is correlated with performance in first and third trials of Synectics, as well as the

third trial of Role Playing, and the third trial of Inductive Thinking is correlated with all other trials except the third trial of Synectics.

This finding is consistent with previous data that teaching performance in Inductive Thinking did not stabilize until the third trial and that Synectics being a relatively less complex model permitted less clinically skilled individuals to excel. However, when moving to a more complex model, Role Playing, the relationship between terminal competence in Inductive Thinking was reestablished.

In general, it seems that clinical performance in the Inductive Thinking model is consistent with performance in most trials of both Synectics and Role Playing. Although patterns of performance within model vary with each model, there is considerable consistency in level of terminal competence reached across similarly complex models.

Criteria of Competence: Are There Relationships?

Four areas or criteria of competence were explored in this study: (1) knowledge of theory; (2) planning ability (also a knowledge or cognitive competence); (3) teaching performance in teaching strategies; and (4) pupil output. In this section we examine the question of relationships among these criteria of competence. The Fall data lend itself to two criteria, that is, to the relationship between planning and teaching competence. Using the three models, we have nine planning-teaching episodes. During the experimental study a wider range of criteria were explored, including two planning-teaching episodes. To assess relationship among the levels, rank

order coefficients using Kendall's formula were computed for all scores.

Relationship between competence in planning and teaching performance. Results of correlations for each planning-teaching episodes on three trials all models appear in Table 7.

Table 7

Rank Order Correlation Between Planning Performance and Teaching Performance for Three Trials of Three Models

	Model		
Trial	Inductive Thinking	Synectics	Role-Playing
1	(19) -.0137	(14) -.1617	(17) .2691
2	(19) .1290	(14) -.0610	(14) .0466
3	(17) -.2583	(12) -.1897	(15) .4848**

*Significant at the .01 level

The direction of relationship and significance appears to be different for each of the models. In Inductive Thinking there were no significant relationships between competency in planning and competence in teaching. Two of the correlations are negative and one was positive. In view of the content oriented nature of the model this finding is somewhat surprising, especially for the third trial

where teaching competency appeared to stabilize.

In the Synectics model all three trials indicated negative, though nonsignificant, relationships between planning and teaching. This bears out earlier findings that planning ability did not seem essential to teaching performance in Synectics.

Finally in the Role Playing model, all relationships are positive and in the last trial the point where stability and the highest level of competence seemed to be reached, this relationship is significant at the .006 level with 15 d.f. (Trial 1 is significant at the .006 level with 17 d.f.)

These findings support a notion that the relationship between planning and teaching performance is dependent on the nature and complexity of the model.

In the Spring experimental study the relationships among competence in (1) Theory; (2) Planning; (3) Teaching; and (4) Pupil Outcomes were investigated. Trainees were given a paper-pencil measure to assess their knowledge of the Inductive Thinking model and the nature of concepts as discussed by Bruner et al. Planning and Teaching Competence were assessed in the same manner as in the Fall. Pupil outcomes were assessed in terms of Recall, Concept Attainment and a Paragraph score. The relationships among the levels will be presented and discussed separately.

Effect of knowledge of theory. Results of correlations among knowledge of theory and other levels of competence appear in Table 8. The two trials are considered separately, the second trial serving as a replication.

The relationships between knowledge of theory and other levels of outcomes appear to be largely negative. Three pupil outcomes measures, overall Concept Attainment and two subscores are significant at the .05 level or better. Interestingly, clinical assessment of teacher performance shows positive but not significant relationship to knowledge of theory.

Relationships of planning competence to teaching competence and pupil outcomes appear in Table 9.

No significant relationships were found between planning competence and teaching competence or planning competence and pupil outcomes.

Relationships of teaching competence to pupil outcomes are found in Table 10.

A significant negative relationship was found between Teaching Performance and scores on the Paragraph Test and a significant positive relationship between Teaching Performance and the Concept Attainment subscores, Identifying Exemplars of the Concept. These findings were not replicated in the second trial.

Discussion of findings on criteria of competence. The results on the relationships among levels of competence are not consistent

Table 8

Relationship of Theory to Planning, Clinical Assessment, and Pupil Outcomes
Trials 1 and 2

Trials	Planning	Clinical Assessment	Recall Paragraph		Concept Attainment	Differentiating Relevancy of Attributes	Labeling Concept Instances	Identifying Examples of Concept	Discriminating Attributes
1	-.6708	.1279	-.4158	.0000	-.5669*	-.1134	-.4619	-.0770	-.6600
2	-.2520	.4315	-.1890	-.2646	-.3402	-.5389*	-.4619*	-.1890	-.2400

*Significant at the .05 to .01 level

Table 9

Coefficient of Correlation Between Planning Competence and Teaching Competence and Pupil Outcomes--Trials 1 and 2

Trials	Clinical Assessment	Recall	Paragraph	Concept Attainment	Differentiating Relevancy of Attributes	Labeling Concept Instances	Identifying Examples of Concept	Discriminating Attributes
1	.0477	.4226	-.3813	.4226	-.0845	.2582	.3012	.4385
2	.1839	.3499	.2333	.3499	.1793	.2988	.4666	-.1195

Table 10

Coefficient of Correlation Between Teaching Competence and Pupil Outcomes Trials 1 and 2

Trials	Recall	Paragraph	Concept Attainment	Differentiating Relevancy of Attributes	Labeling Concept Instances	Identifying Examples of Concept	Discriminating Attributes
1	-.4835	-.6565*	-.0806	.2517	-.2872	.4513*	-.3763
2	.0000	-.1482	.0741	-.3397	-.0377	-.1482	-.1177

*Significant at .05 to .01 level

from Fall to Spring or from model to model. It seems likely that the ability to plan and other cognitive competencies is more critical to teaching at the beginning of training when teaching competence is less developed and perhaps more unstable. There is also a strong likelihood that relationships between planning and teaching are a function of the complexity of the performance or model. Full interpretation of the results of the Spring study on the relationships to pupil output will be made in the context of Part II, the influence of learning styles, especially pages

In general, ranks on Clinical Assessment of model performance were not entirely what we expected. In addition, we suspect that model (or teaching stragegy) and teaching style are separate factors in the determination of pupil outcomes. The rank-order correlation analysis applied to pupil outcomes here is not entirely appropriate because of the lack of adjustment for I.Q.; a strong factor in most of the pupil outcome measures. Finally, reliable differences in pupil outcomes need to be assessed over longer periods of time. In the Spring Study reported here neither the teaching performance nor the pupil performance as from Trial 1 to Trial 2 was stable enough to draw conclusions about either consistency or the relationship of criteria of competence. These findings support Turner's philosophy that although pupil outcomes are the highest levels of criteria, obtaining reliable data for that level requires a long period of time, perhaps one or two years of teaching experience beyond the initial training period.

Conclusions and Questions on the
Developmental Study of Teacher Competency

Practice seems to increase the level of teaching competency attained across the models, although the improvement was significant only for Inductive Thinking. It is difficult to know if this finding would be replicated were the order of training changed (i.e., if Synectics or Role Playing were practiced before Inductive Thinking or if the models were taught later in teacher training). More studies are needed to determine when, for whom, competence in a model is stabilized. When the Spring study is taken into account, it appears that three trials on a model is not enough, particularly for some individuals and for some models. Satisfactory terminal level competence, for example, was not reached by many of the trainees in the group. Performance on the Inductive Thinking model decreased over time, for some to the level of minimal entry competency. A further investigation of interest would be to conduct an item analysis of Clinical Assessment measures to determine if, for most trainees, the same teaching skills (or teacher behaviors) constitute the last 15-20% of competency in each model.

In analyzing the consistency of teachers in areas of performance, we found evidence that individuals are consistent across models in planning ability although the trials in which stabilization of performance occurs differ from model to model. Although individual consistency of teaching performance varies according to model, there is individual consistency across models in terms of level of terminal

teaching competency attained. This evidence seems to indicate that while individuals may respond or develop competency differently according to the model being learned, they are consistent in terms of planning and teaching competency across models.

Generally speaking, in the more complex content oriented models (Inductive Thinking and Role Playing) planning ability is superior to teaching performance. The ability to plan seems less essential to teaching in a process oriented model like Synectics, where planning ability was inferior to teaching ability.

The analysis of relationships among criteria of competence (knowledge of theory, planning competence, teaching competence and pupil outcomes) did not reveal clearly significant relationships. It appears that at least in training, planning competence is important to teaching competence in Role Playing. We believe the question of relationships among criteria of competence and the expectations researchers and practitioners have about the optimal context and time period for ascertaining those relationships is an important one. However, we feel that neither the design nor the data in this study adequately explored this question.

Part II: The Influence of Teacher Trainer Learning Style on Training and Pupil Outcomes

Part II of the study employs the same concepts to describe competency as Part I (planning competence, teaching competence and terminal competence), but analyzed these training variables in terms

of the four trainee learning styles. The first set of questions concerns the influence of trainee learning styles on response to training. Specifically, how does learning style affect (1) terminal competence; (2) performance improvement; (3) predisposition for a particular model of teaching? The second set of questions examines the influence of trainee learning styles on pupil outcomes more specifically on recall, and concept attainment.

Demography of Teacher Trainee Learning Styles

The distribution of the twenty-two trainees among the four learning styles can be found in Table 11. Data on the academic history of the four styles are also provided.

Table 11

Academic History of Four Trainee Learning Styles

Style	Population N	Population %	Completed	Transferred: Academic Program	Transferred: Teaching Program	Incomplete
I	6		1	1[a]	2	2
II	7		7		1[b]	
III	5		5	1		
IV	4		2	1	1	
Total	22	100%	15	3	4	2

[a]Transferred but also incomplete

[b]Picked up a double major

Within the program there was a high rate of attrition, particularly for Learning Styles I and IV. In all cases the transfer into another teaching program was to the field of Special Education. Part of this movement can be accounted for by the job market for teachers in 1974.

Influence of Learning Styles on Training

Data on terminal competence in the Inductive Thinking Model in both planning and teaching performance for the four learning styles appear in Table 12 and Figure 7.

Table 12

Terminal Competence: Inductive Thinking Model

	Percent			
	Teaching		Planning	
Style	Mean	S.D.	Mean	S.D.
I	64.58	6.9	100.0	0.00
II	95.54	5.6	84.13	29.99
III	84.38	10.7	97.22	5.55
IV	89.58	12.5	85.19	25.45

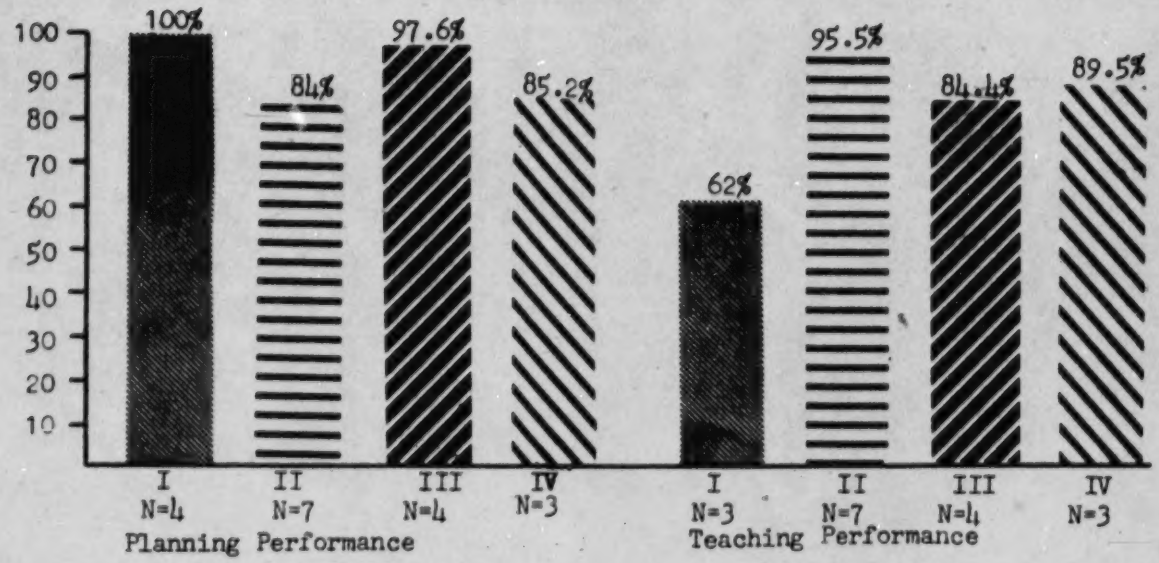

Figure 7

Inductive Thinking: Terminal Competence

When compared to the group average (90.74%) in Planning, Styles II and IV appear to fall below the mean and have the greatest within group variability. For teaching competence, the results are reversed with Styles I and III falling below the group mean (86.4%), with Style I falling considerably below the average on terminal teaching competence. This would indicate that for the Inductive Thinking Model, relative differences between planning ability and teaching ability appear to be related to differences in trainee learning styles. A test for the analysis of variance among the styles on terminal competence in the Inductive Thinking Model indicates a statistically significant difference at the .01 level (F = 8.8658

with d.f. = 3,13). The differences in planning competence were not significant. In view of previous findings that terminal teaching competence in the Inductive Thinking Model is highly related to terminal competence in the other models and to competence over time, the statistical difference in terminal teaching competence also has significant educational implications. Terminal competence for Style I, 64.58%, is above minimal competence of 56.25% but below the established terminal level of 81.25%. The statistical significance indicates that terminal competence level for Style I on this model was insufficient.

Terminal levels of planning and teaching competence for the Synectics Model appear below in Figure 8 and Table 13.

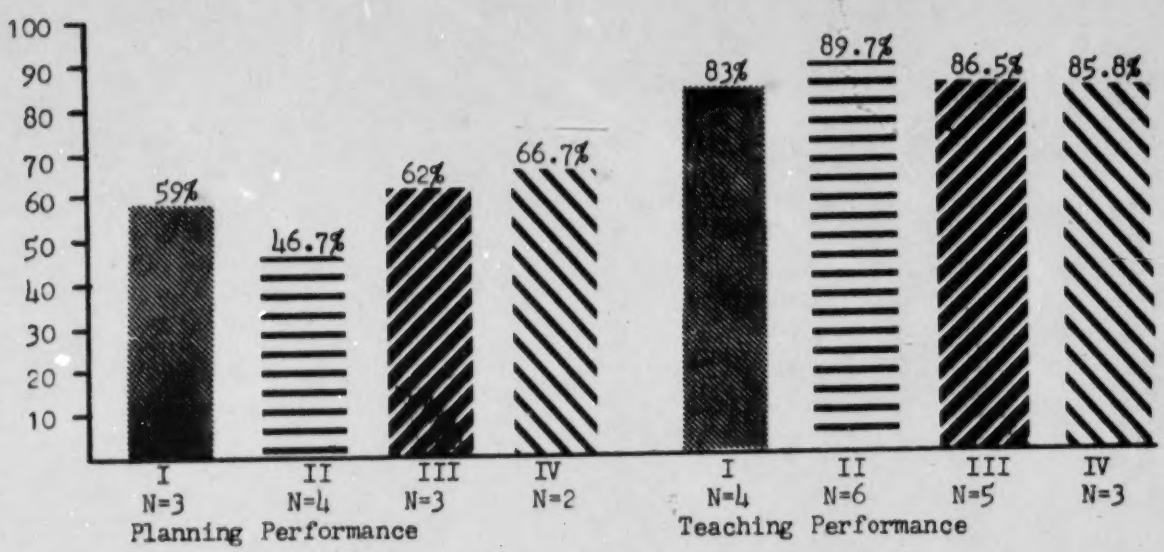

Figure 8

Synectics: Terminal Competence

Table 13

Terminal Competence in the Synectics Model for Four Learning Styles

Style	Teaching Competency %		Planning Competency %	
	Mean	S.D.	Mean	S.D.
I	74.04	27.0	59.26	27.66
II	89.75	5.8	47.22	16.67
III	86.15	17.3	62.96	25.66
IV	85.92	8.8	66.67	31.43

In this model planning competence is considerably lower than teaching competence in Synectics and lower than planning competence in the Inductive Thinking Model. Style II is well below the group average on planning of 57.41%. Very few reliable conclusions can be drawn from the Synectics Planning data due to the general inconsistency in the types of planning forms that were submitted and the large quantity that were missing (40% of Type II planning scores were missing). Differences in terminal teaching competence among the four styles are not large, though Style II again performs slightly better than the others and Style I the lowest. The terminal teaching competence for all styles was above the level established by the program, 80.77%. Styles I and III improve in terminal competence from Inductive Thinking while Types II and IV decline. Within group

variability for Styles I and III is greater than for Styles II and IV. Synectics is thought to be the least complex of the three models. It is possible to assume that due to time or the reduction in the complexity of the model, some, not all, trainees in Styles I and III strengthened in their clinical teaching skills.

Terminal competence levels in the Role Playing Model appear in Figure 9 and Table 14.

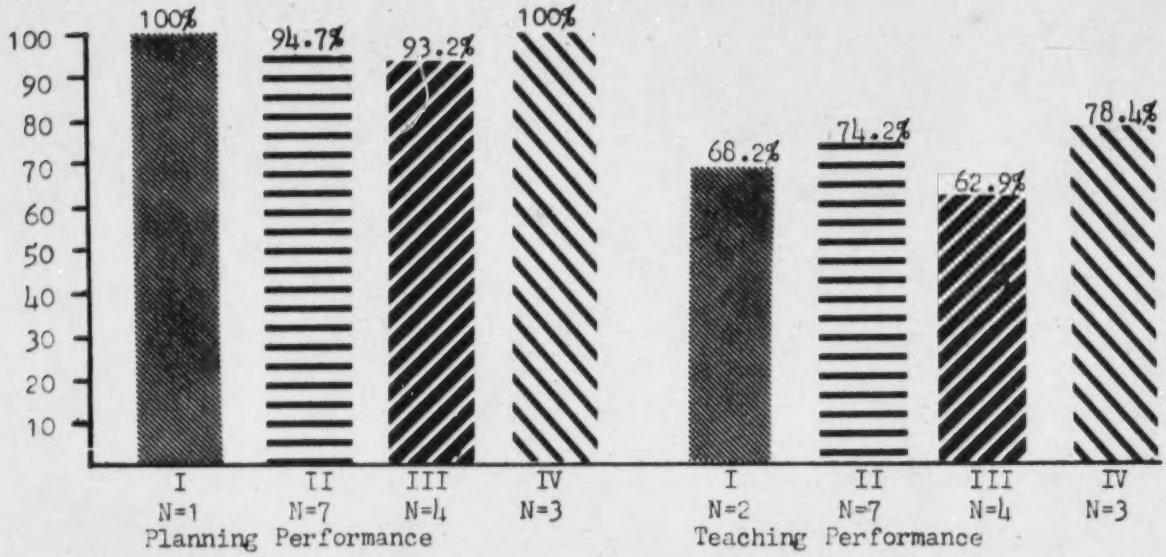

Figure 9

Role Playing: Terminal Competence

Table 14

Terminal Competence: Role Playing,
Means and Standard Deviations

Style	Teaching %		Planning %	
	Mean	S.D.	Mean	S.D.
I	68.12	8.8	100.00[a]	0
II	76.11	12.3	94.85	7.15
III	62.99	39.7	93.18	8.70
IV	78.38	19.3	100.00	0

[a] N = 1

For all styles planning ability exceeds teaching ability with differences among styles on planning competence very small. These differences are greater for terminal teaching competence, Styles II and IV again exceeding Styles I and III. None of the styles attained the terminal competence level set by the program, 79.5%. Within group variability is greatest for Style III, although the samples are so small for Styles I and IV it is difficult to make comparisons. Examination of teaching competence over all three trials (Appendix D) reveals that for all groups the variability in teaching competence is greater for the Role Playing Model. For Style III and IV the variability appears to increase. Apparently some individuals within Style III are not able to acquire competence in Role Playing. There also appears to be a ceiling effect for Style IV.

Indication of predisposition for a model was obtained by comparing the terminal teaching competence for each pair of models by learning styles. Researts of these difference scores are shown in Table 15.

Table 15

Predisposition for a Model of Teaching: Means and Standard Deviations of Difference Scores on Terminal Competence by Trainee Learning Styles

	Synectics/ Inductive Thinking		Synectics/ Role Playing		Inductive Thinking/ Role Playing	
Style	Mean	S.D.	Mean	S.D.	Mean	S.D.
I	1.45	.07	1.55	0.0	1.11	0.0
II	.945	.098	1.26	.184	1.27	.17
III	.965	.104	3.51	4.79	3.98	5.81
IV	.967	.147	1.12	.23	1.16	1.17

When the levels of terminal teaching competence were compared across models for each style, significant differences appear in the predisposition of Style I in favoring Synectics over Inductive Thinking ($F = 12.006$ with d.f. = 3,11, significant at the .01 level). Based on terminal competence scores, Styles II, III, and IV show a slight preference for Inductive Thinking to Synectics. All styles prefer Synectics to Role Playing, Style III more so than the other styles though this preference shows great variation within Style III. All four styles show a preference for Inductive Thinking over Role Playing,

again Style III showing greatest preference. A summary of these difference scores into ranks appears below (Table 16).

Table 16

Predisposition for a Model of Teaching: Ranks of Difference Scores on Terminal Competence for Trainee Learning Styles

Style	Inductive Thinking	Synectics	Role Playing
I	2	1	3
II	1	2	3
III	1	2	3
IV	1	2	3

A profile of teaching competence scores on three trials of three models for each learning style appears in Figure 10.

Examination of gain scores between the first and second and first and third trials for each model by analysis of variance reveals significant differences in improvement among the four styles only between the first and second trials of the Inductive Thinking Model ($F = 3.52$ with d.f. = 3,14, significant at .05 level).

Inspection of the distribution in Figure 10 indicates greatest similarity in improvement patterns among the four styles between the second and third trials for all models. Although additional trials would be necessary to establish the point where stability of competence is definitely reached. it seems certain that it is not reached at the

second trial. On two of the models Style I shows large gains between the first and second trials and minimal gains thereafter. Conceivably there is a ceiling effect after the second trial for this style.

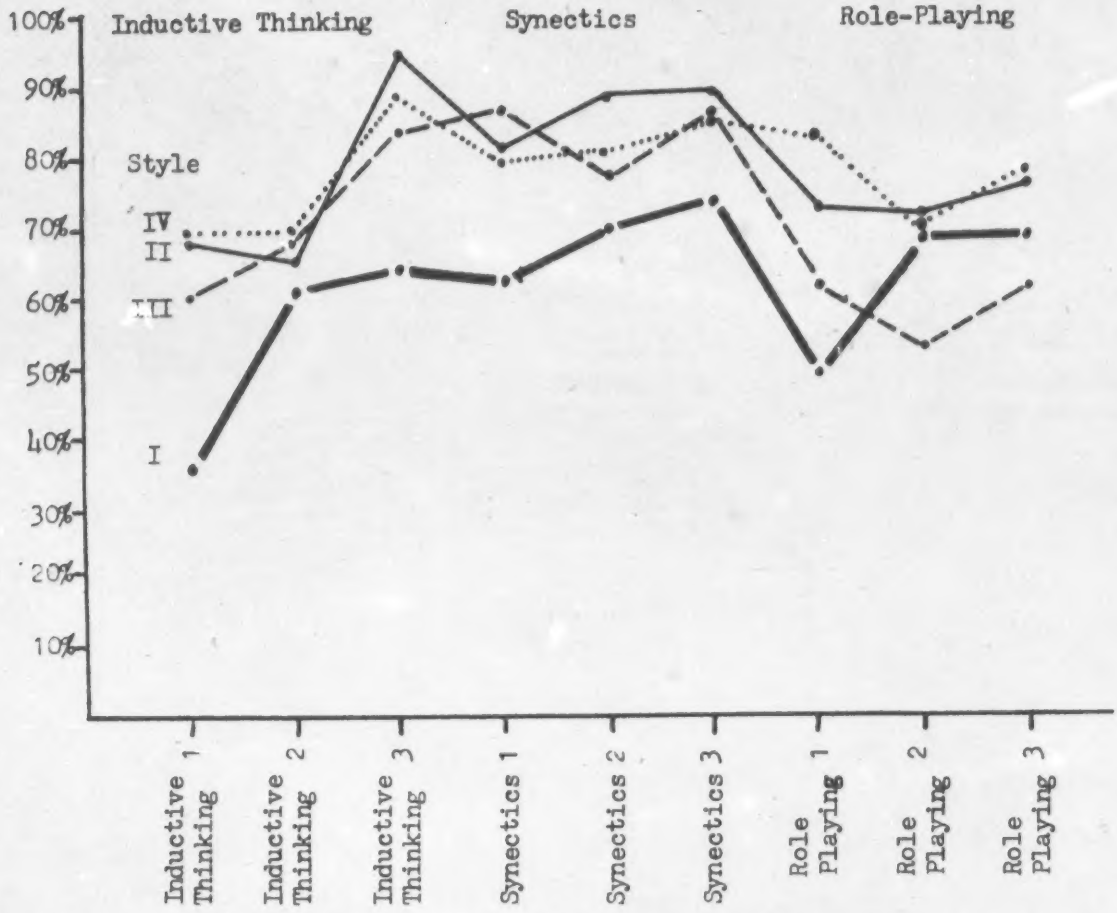

Figure 10

Teaching Performance: Three Models of Teaching by Learning Style

Some additional light on the question of stability of competence can be found by examining the clinical assessment scores on the Inductive Thinking model obtained during the Spring experimental study, although these results must be viewed with caution due to the small sample and size (N = 8) and select nature of the sample size, two from each style. Table 17 indicates the mean level of teaching competence for the sample of eight for five trials of the Inductive Thinking model, fall and spring. Comparison with the large population is also shown in Table 17. The trend over time can also be seen in Figure 11.

Analysis of the data in Table 17 and Figure 11 reveals that for the group as a whole the Spring level of competence dropped considerably, in Trial 1 to the minimal level of terminal competence and in Trial 2, below the minimal level. Style I and III appear to be functioning above the level of terminal competence attained in the Fall (62% and 84.4% respectively) and Style II and IV below the Fall level (95.5% and 89.5% respectively). When the relative ranks of the sample of eight are compared for Fall and Spring (see Table 18), the differences between Fall and Spring are further confirmed.

The relative ranks appear stable in the Fall but not in the Spring. The meaning of these results is difficult to assess. It is not clear whether the experimental situation is adversely affecting the performance of Styles II and IV or whether scores over time are generally unstable. It is reasonable to assume the Styles I and III have grown progressively stronger in general clinical competence with time. The decline in Style II on Spring Trial 2 is partially explained

Table 17

Stability of Competence: Means and Standard Deviations on Fall-Spring Trials of Inductive Thinking Model for Trainee Learning Styles

	Percent									
	Fall: Trial 1		Fall: Trial 2		Fall: Trial 3		Spring: Trial 1		Spring: Trial 2	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
I	28.13	15.62	59.39	3.12	--	--	78.13	3.12	75.00	6.24
II	90.63	9.37	87.50	0	93.75	6.25	84.38	3.12	78.13	15.62
III	61.54	15.38	65.63	21.87	90.62	3.12	87.50	0	87.50	5.25
IV	71.88	2.29	71.88	15.62	100.00[a]	0	75.00	6.24	78.13	9.37
N = 8	63.04	25.68	71.09	17.09	93.75	5.59	81.25	6.25	79.69	11.16
Entire Population N = varies	60.03	21.51	66.45	16.45	86.40	13.84				

[a] N = 1

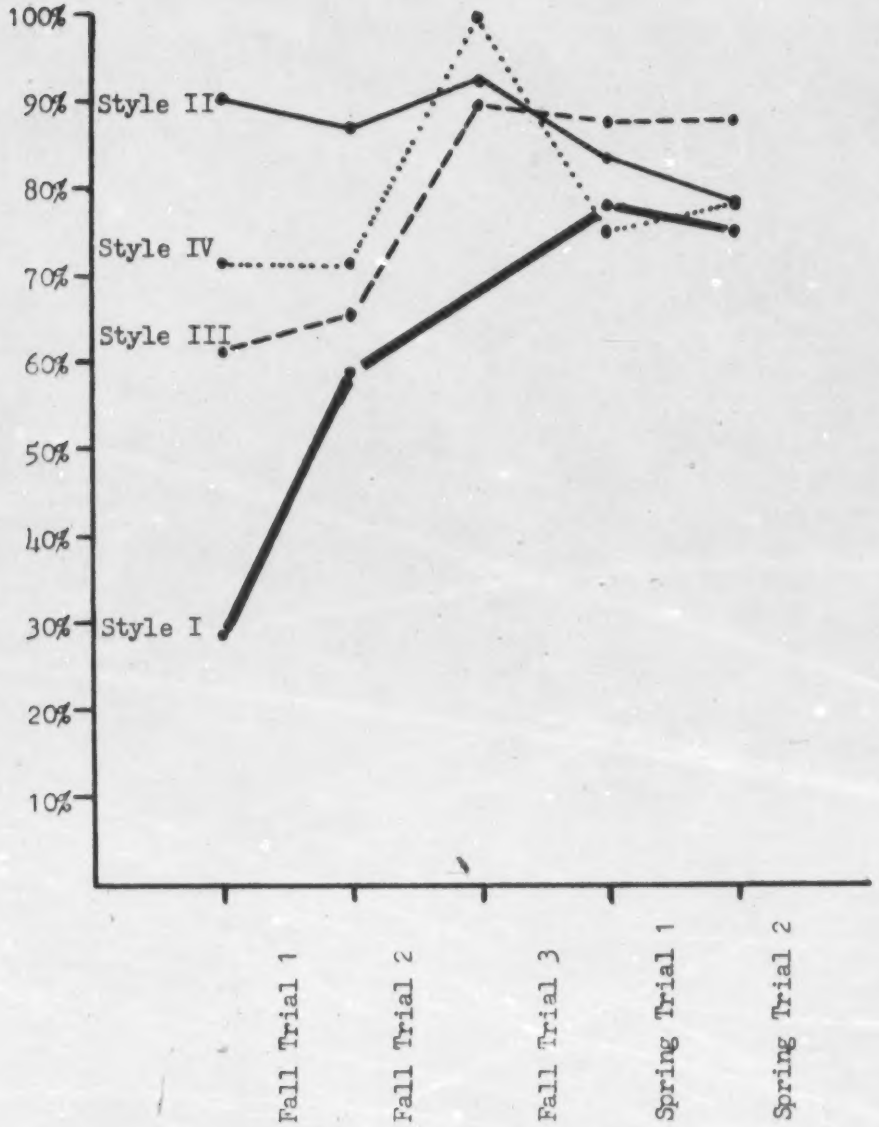

Figure 11

Stability of Competence: Means on Fall-Spring Trials of Inductive Thinking Model for Trainee Learning Styles

by the large standard deviation, a low score of one of the two Style II trainees.

Table 18

Rank Order Scores for Trainee Learning Styles on Five Trials of the Inductive Learning Model

	Fall Trial 1	Fall Trial 2	Fall Trial 3	Spring Trial 1	Spring Trial 2
I	4	4		3	2
II	1	1	1	2	3.5
III	3	3	3	1	1
IV	2	2	2[a]	4	3.5

[a] N = 1

In the initial training Styles II, III and IV appear similar in their overall levels of competence and learning patterns as compared to Style I. The learning patterns of all styles seem to be partially a function of the nature of the model.

On the basis of planning and teaching competence across three models for the four learning styles, the following appears to hold for initial training:

1. For all learning styles level of competence vary with the complexity of the model.

2. Planning competency generally exceeds teaching competency, especially in less complex, process-oriented models.

3. Styles I and III appear to be relatively stronger in planning than in performance.

4. Style III consistently shows greater variability as a group within their teaching performance, while Style II the least. For Styles I and IV within group variability tends to vary with the model.

Influence of Learning Styles on Pupil Output

At the end of the Spring semester, eight trainees, two from each learning style, participated in an experimental study in which each trainee taught two lessons to a small group of fifth grade students using the Inductive Thinking Model. The pupils were randomly assigned to treatment groups. The trainees were instructed to develop the sociological concepts of folkways, sanctions and values in both lessons using different data bases (social life in Roussillion, France for the first lesson, and social life in medieval England for the second). A read-only control group was included in the study. Pupils were tested for Recall, Concept Attainment and Application of the concepts in a Paragraph. Results of these measures appear in Table 19.

Recall. Analysis of adjusted Recall scores among the four groups and the control group for the two lessons reveals some inconsistency in both overall scores and ranks between the two lessons. On the first teach Style I out performs the rest followed closely by Style IV. Style II is third, followed closely by the

Table 19

Effect of Trainee Learning Styles on Pupil Output: Means and Standard Deviations for Recall, Concept Attainment and Paragraph Scores

	Recall				Concept Attainment				Paragraph			
	Teach 1		Teach 2		Teach 1		Teach 2		Teach 1		Teach 2	
Style	Means*	S.D.*	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
I	16.49	5.25	13.75	4.97	8.68	3.90	8.41	3.00	7.09	4.76	3.01	2.2
II	14.95	3.50	14.58	4.26	10.53	4.85	10.99	4.10	4.73	3.52	3.26	1.7
III	13.04	4.21	13.92	4.57	9.07	3.35	7.58	4.50	5.49	4.86	2.51	2.5
IV	16.00	2.67	14.67	2.95	9.71	2.41	7.59	2.48	9.26	5.35	3.37	1.3
Control	14.88	5.45	14.57	6.46	8.97	4.32	8.36	4.27	7.34	5.78	2.91	2.9

* Means have been adjusted for differences in I.Q. S.D. is based on the unadjusted means.

Control Group. Style III is out performed by the Control Group. Analysis of Variance for Teach 1 reveals significant differences among the four styles after effects of I.Q. were removed through regression analysis. ($F = 3.007$ significant at the .05 level with d.f - 3,42).

On Teach 2, Style IV outranks II and the Control Group. Style III improves slightly, still falling below the control group. The average Recall score drops somewhat for Style IV and considerably for Style I. Style I dropped from first ranked in Trial 1 to last rank in Trial 2. There are several interesting points in this score. First, the low performance of Style III on Teach 1 in comparison to the Read-only control group may indicate that something in the style turns students "off" to learning. Second, Styles I and to some extent, Style IV appears to be less consistent than Style II and III, reinforcing the training findings previously discussed.

Concept Attainment. Results of the adjusted Concept Attainment Scores shows Style II ranked first on both teaches, Style IV is ranked second on Trial 1 and 4.5 on Trial 2. Style III third and 4.5 in Trial 2. Style I fifth and 2.5, behind the control group in Teach 1. Except for Style II, Concept Attainment Scores in all groups decline from Teach 1 to Teach 2. The differences among the groups after removing the effects of I.Q. are not significant. ($F = 2.58$ with d.f. = 3,42. Significance at the .05 level with d.f. = 3,42 is $F = 2.83$). However, analysis of the Concept Attainment subscores, Table 20 and Table 21,

Table 20

Teach One: Concept Attainment Subscores

	1d Discriminating Attribute		1c Identifying Examples of Concepts		1b Labeling Concept Instances		1a Differentiating Relevancy of Attributes	
Style	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
I	3.75	1.30	1.86	1.25	1.44	1.52	1.67	1.41
II	4.08	1.27	2.61	1.60	1.96	1.76	2.46	1.32
III	2.92	1.66	2.58	1.58	1.35	1.27	2.49	1.28
IV	3.73	.86	1.91	1.48	2.00	.69	2.29	1.09
Control	2.78	1.27	2.42	.90	1.48	1.38	2.61	1.65

Table 21

Teach Two: Concept Attainment Subscores

	1d Discriminating Attribute		1c Identifying Examples of Concepts		1b Labeling Concept Instances		1a Differentiating Relevancy of Attributes	
Style	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
I	1.78	.90	2.08	1.60	2.44	1.37	2.15	1.22
II	2.35	.88	2.29	1.33	3.31	2.10	3.30	1.52
III	1.88	1.18	1.97	1.44	2.17	1.88	1.76	1.47
IV	2.23	.76	1.32	.94	2.40	.83	1.80	.83
Control	2.34	1.16	1.71	1.06	2.40	1.73	1.95	1.68

did indicate a significant difference among the group on the second trial for the Subscore, Differentiating Relevancy of Attributes. ($F = 4.00$ significant at the .01 level with d.f. = 3,42.)

On most Concept Attainment Subscores (Tables 22 and 23) Style II outperforms the other three styles and the control group especially in the second trial. The order of the performance among the other styles is not so consistent either within or between lessons.

Paragraph. On the Paragraph Measure, see Table 19, Style IV outperforms the other groups on Teach 1 with Styles I, II and III falling behind the control group. On trial 2, the differences among the first and second ranked, Styles II and IV, are small with the control group outperforming Style III. Analysis of Variance with the effects of I.Q. removed through Regression Analysis revealed no significant differences on either trial though Trial 1 score approaching significance, $F = 2.49$ with 3.42 (significance with d.f. = 3.42 is $F = 2.83$).

The Paragraph Test was intended to measure the use of concepts in an open situation. In fact, the measure tended to pull factual information about the cultures. This would explain the performance of Styles I and IV on Trial 1 which would be consistent with the earlier analysis of recall scores.

A summary of the ranks for all pupil output scores appears in Tables 22 and 23. Ranks were assigned very conservatively with two scores separated by less than one-tenth of a point given the same rank.

Table 22

Summary of Ranks: All Pupil Output Scores--Teach One

	Recall	Concept Attainment	Discriminating Attributes	Identifying Examples of Concept	Labeling Concept Instances	Differentiating Relevancy of Attributes	Paragraph	Total of Ranks
I	1	5	2.5	5	3.5	5	3	25
II	3.5	1	1	1.5	1.5	2.5	5	16
III	5	3	4	1.5	5	2.5	4	25
IV	2	2	2.5	4	1.5	4	1	17
Control	3.5	4	5	3	3.5	1	2	22

Table 23

Summary of Ranks: All Pupil Output Scores--Teach Two

	Recall	Concept Attainment	Discriminating Attributes	Identifying Examples of Concept	Labeling Concept Instances	Differentiating Relevancy of Attributes	Paragraph	Total of Ranks
I	5	2.5	5	2	2	2	3	21.5
II	2.5	1	1	1	1	1	2	9.5
III	4	4.5	4	3	5	5	5	30.5
IV	1	4.5	3	5	3.2	4	1	22
Control	2.5	2.5	2	4	3.5	3	4	21.5

Analysis of performance by ranks shows Style II is clearly ahead of the other groups on model-relevant outcomes (Concept Attainment) and over-all rank. Styles I and II improved with practice while Styles III and IV dropped.

Summary of findings on the effects of trainee learning style on pupil outcomes. On the basis of the previous analyses several tentative statements can be made about the effects of the four learning styles. First, it appears that Style II is consistently stronger in pulling lower and higher order outcomes and Style III least strong. Style IV shows a strong positive influence on lower order pupil outcomes and to a lesser extent, higher order outcomes. Style I can exert a very positive influence over lower order outcomes and considerably less effective with higher order outcomes. In addition, the quality of instruction from Style I and IV appears inconsistent over time. In general it would appear that Styles II and IV are over-all the strongest teachers with Styles II and III the most consistent. Style I probably can do some things very well. Style III is systematically less effective. The pattern of consistency based on pupil effects among each of the Styles does not appear to confirm the patterns observed in the training sequence.

Several other thoughts about these findings are worth noting. First, although not all measures reached statistical significance, the direction of differences for Styles II and III seems stable. If one considers these differences in influence on learning over a

period of years, they are likely to be of much greater importance especially in contrast to one or two lessons under experimental conditions. Second, it is possible that no teaching or materials mediated teaching is better than some teaching; even for so-called high-order outcomes. The phenomenon of "teacher-turnoff" is one that bears more investigation. Finally, since this study virtually controlled for "method" we can assume that differences are a function of teaching style (as opposed to teaching strategy). It would be worthwhile to examine the different learning styles for the verbal interaction patterns that comprise a teacher's style.

Although all results in this investigation should be interpreted with caution, we believe that several aspects of the study merit replication and further investigation.

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